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Estimating the Cost of Shipbuilding in the USSR

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Estimating the Cost of Shipbuilding in the USSR


Office of Strategic Research

August 1977

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Summary

A model used by the Soviets to estimate the cost of merchant ships has been adapted by OSR to estimate the cost of the basic portion of Soviet naval surface ships. The term "basic portion" means the total ship less its weapons and electrical and electronics equipment.

The model uses cost-estimating relationships (CERs) derived from actual experience at shipyards in the European USSR, where nearly all Soviet merchant ships and most naval surface ships are constructed. It provides CERs for the major groups of ship components. In addition, it gives cost adjustment factors for special characteristics that may be incorporated in a ship. This permits the model to be used to estimate the costs of naval ships, because these adjustments cover the major special features found on basic naval combatants.

To test the accuracy of the model, we have used it to estimate the cost of 17 Soviet merchant ships for which actual costs and technical data are available from independent sources. In every case, the estimates fall within 14 percent of actual costs—and for 10 of the ships the range is only 5 percent—thus proving the method to be an excellent predictor of the costs of merchant ships.

Use of the model on a sample of 26 Soviet naval ships showed results consistent with those derived by applying a model developed by the Rand Corporation to cost US naval ships in dollar terms. This consistency tends to confirm the validity of adapting the Soviet merchant ship model to costing naval ships.

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The accuracy of the model in producing average costs of ships of a given class makes it an excellent tool for deriving ruble-dollar ratios for the Soviet and US shipbuilding industries. Use of the model indicates ruble-dollar ratios ranging from .45 to .60 (1970 rubles to 1973 dollars) for Soviet merchant ships and from .50 to .75 for Soviet naval ships.

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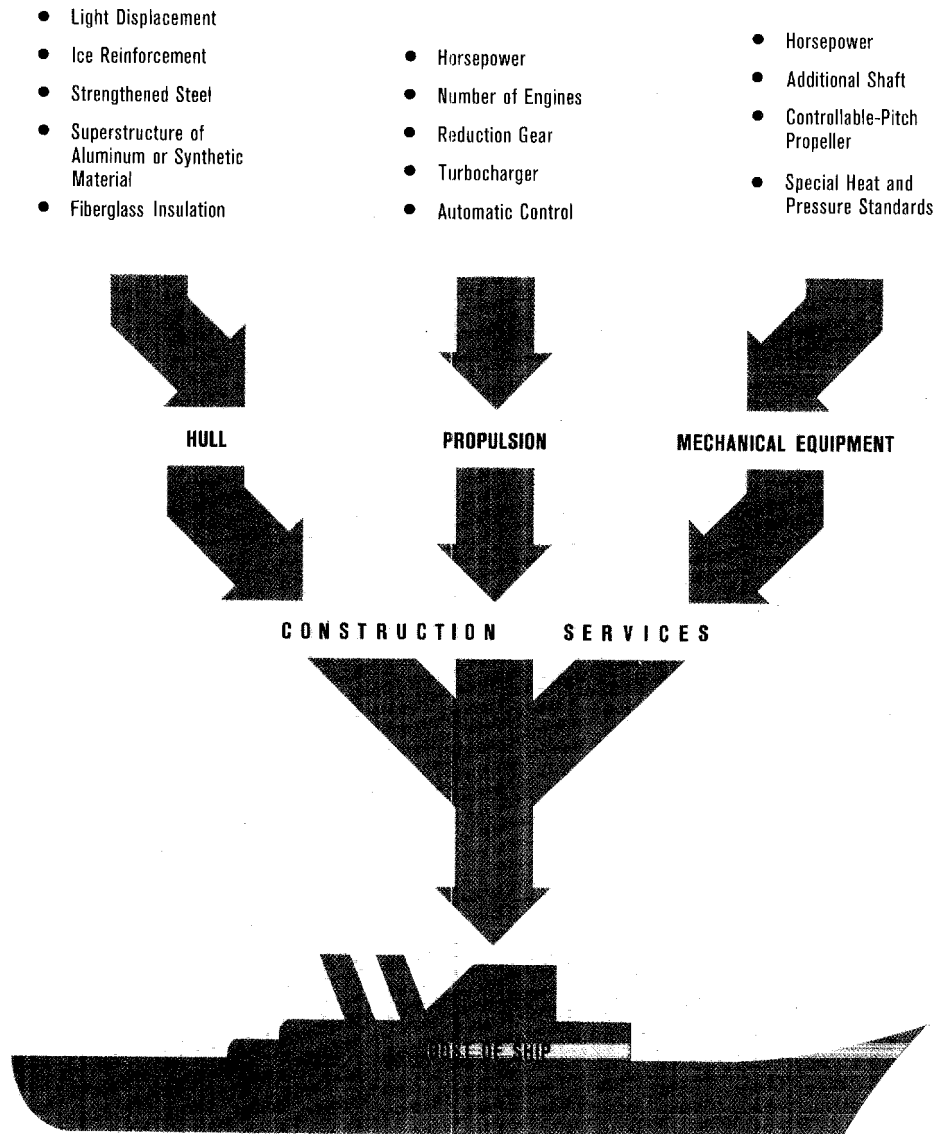
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Figure 1
Factors in Costing Ship Construction



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Estimating the Cost of Shipbuilding in the USSR

Introduction

This paper describes a model used by the Soviets to estimate the cost of their merchant ships and adapted by OSR to estimate the cost of the basic portion of their naval surface ships. The paper also discusses tests applied to determine the validity of the model, outlines its application to the problem of estimating the cost of Soviet naval ships, and examines the ruble-to-dollar ratios that result from applying it to both Soviet and US ships.

The Model

The Soviet model was developed at the Central Scientific Research Institute and the Leningrad Central Planning and Design Bureau of the Ministry of the Maritime Fleet. It is described in ☐

☐ Soviet monograph by V. I. Krayev, O. K. Stupin, and E. L. Limonov, well-known specialists in the economics of shipbuilding.¹

The authors describe the model as the most complete methodology available for estimating the cost of constructing Soviet merchant ships. It was designed for use by specialists engaged in planning the development of the maritime fleet and in estimating the costs of constructing new classes of vessels. The model is used to estimate prices that would be charged at Soviet shipyards—that is, full product cost (*sebestoimost'*) plus normal enterprise profit.

¹V. I. Krayev, O. K. Stupin, and E. L. Limonov, *Economic Substantiation in the Design of Seagoing Cargo Vessels*, trans. JPRS 63050, 1974.

The cost-estimating relationships (CERs) developed for the model are derived from experience at shipyards in the European USSR. Almost all Soviet merchant ships and most naval surface ships are constructed at these yards. The model includes cost adjustment factors for ships constructed in the northern or far eastern USSR. The CERs are based on 1972 price norms.

Major Component Groups

For estimating purposes, the model divides the ship into three major component groups—hull, main propulsion system, and mechanical equipment—and adds the cost of construction services.² The US Maritime Administration and the US Navy use similar groups of components in preparing cost estimates for constructing ships.

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The model also provides cost adjustment factors which take into account special features of each component group on merchant ships (Figure 1). These adjustment factors are vital to our ability to apply the model to naval surface ships.

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Hull

The cost of the hull is estimated as a mathematical function of light displacement³ and the mission of the ship. The model also provides a capability to adjust this cost for special features, including:

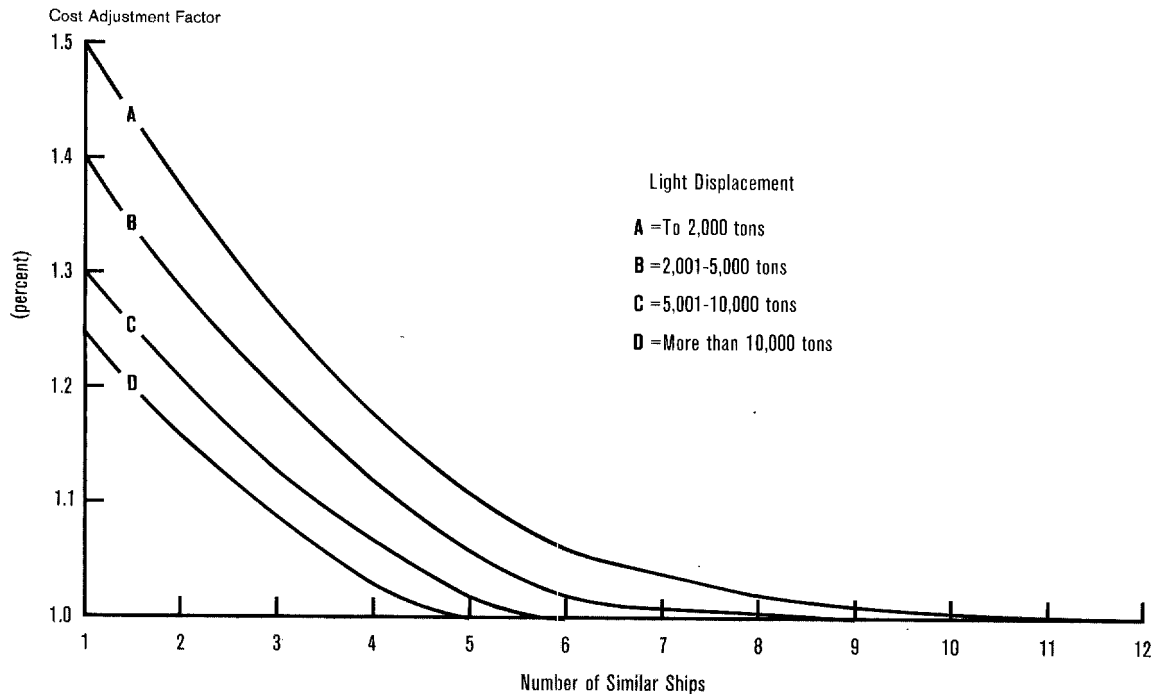
²A detailed breakdown of items included in each group is shown in appendix A.

³Weight of a merchant ship, in tons, with machinery and ready for service, but without crew and their effects, consumable items, or variable load.

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Figure 2
Cost Adjustment Curves For Multiple Production of Ships With Varied Light Displacement



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- ice reinforcement,
- use of strong, higher quality steel,
- a superstructure constructed of aluminum or a synthetic material, and
- fiberglass insulation.

Main Propulsion System

The cost of the main propulsion system is estimated as a function of the number and types of engines, their horsepower and speed, and the type of transmission. Special adjustment features can account for:

- reduction gears,
- turbocharging, and
- automatic control.

Mechanical Equipment

The cost of mechanical equipment is estimated to be a function of the type and power of the main engine, the type of propulsion shafts, and the ship's mission. Special adjustments can be made for:

- additional shafts,
- controllable-pitch propellers, and
- special temperature and pressure standards.⁴

Construction Services

The cost of construction services is estimated as a function of light displacement and the ship's mission.

⁴To be used when temperature and pressure in the engine and boiler exceed 470°C and 40 atmospheres, respectively.

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Scale of Production

The model also considers the effect of production scales on the cost of a ship. When units of a similar type are constructed sequentially in the same shipyard, the cost per ship decreases through the first few units. The rate of decrease in the marginal cost of a ship depends primarily on the ship's light displacement and the number of units constructed in a class. According to the model, the lighter ships benefit more from economies of scale than the heavier ones. In addition, these benefits continue longer with light ships (Figure 2). For ships with light displacements up to 2,000 tons, reduction in cost continues through about the 12th ship in the class. On the other hand, for ships of more than 10,000 tons the Soviets believe that there is no reduction in cost after the fifth unit. Analysis of the cost and production data given in the model indicates that the Soviets expect learning curves of about 88 to 90 percent for all types of ships.

Other Factors

The cost can be further adjusted to take into account the location of the shipyard if the ship was not constructed in the European USSR. In addition, the model can be modified to take into account the cost of accommodating the additional crew carried on naval ships.

Accuracy of the Model

The Soviet authors do not provide quantitative measures of the accuracy of the model in predicting the costs of Soviet merchant ships. To test its accuracy, the model was used to derive the costs of 17 Soviet merchant ships for which actual costs and technical data are available from independent sources.⁵

⁵O. A. Novikov, *Ekonomika I Eksploatatsiya Morskogo Flota, Trud: No. 130* (Economics and Operations of the Maritime Fleet, No.130) (Leningrad: Izdatel'stvo Transport, 1971), pp. 12-17.

A. Ye. Berkov, N. V. Dymchenko, and O. A. Novikov (editors), *Tsennik No. 27 Dlya Pereotsenki Sudov Morskogo,*

As shown in Table A and Figure 3, the model proved to be a highly accurate predictor of actual cost for the 17 ships. All of the estimated costs fall within a range of minus 8 to plus 14 percent of actual costs; in 10 cases they fall within plus or minus 5 percent. While the size of the sample is too small for more definitive testing, the differences appear to be random and not biased by ship size or class.

Application to Naval Ships

The Soviet cost model was designed to estimate the cost of merchant ships, but it can be adapted for the basic portion of naval surface ships (total ship less weapons and electrical and electronics equipment) because of some similarities between basic naval and merchant ships.

An examination of shipbuilding practices in the US reveals that hull costs per ton and propulsion machinery costs per shaft horsepower are almost the same for merchant and naval ships. Moreover, there is little difference in the construction costs of a basic US naval ship and that of a merchant ship of the same displacement and horsepower. It had been thought that different construction standards for merchant and naval ships would greatly alter their respective costs, but this factor has not proven to have had much impact on expenditures. The studies of US ships indicate that naval ships have a higher total cost than merchant ships almost entirely because of the costs of outfitting, armaments, electrical and electronics equipment, and auxiliary machinery—that is, those systems that are required specifically for the fulfillment of the naval ship's mission.⁶

On the Soviet side, there do not appear to be major differences in the construction norms of the basic portion of naval and merchant ships. In addition, intelligence analysis indicates that shipbuilding practices in Soviet yards are almost the

Rechnogo, I Rybopromyshlennogo Flota na 1 Yanvarya 1973 Goda, (Price List No 27 for Reappraisal of Ships in Maritime, River, and Fishing Fleets—1 January 1973) (Moscow: Izdatel'stvo Transport, 1972).

⁶J. A. Fetchko, *Cost Comparison, Naval vs. Commercial Ships*, Naval Ship Systems Command, Dec 1971.

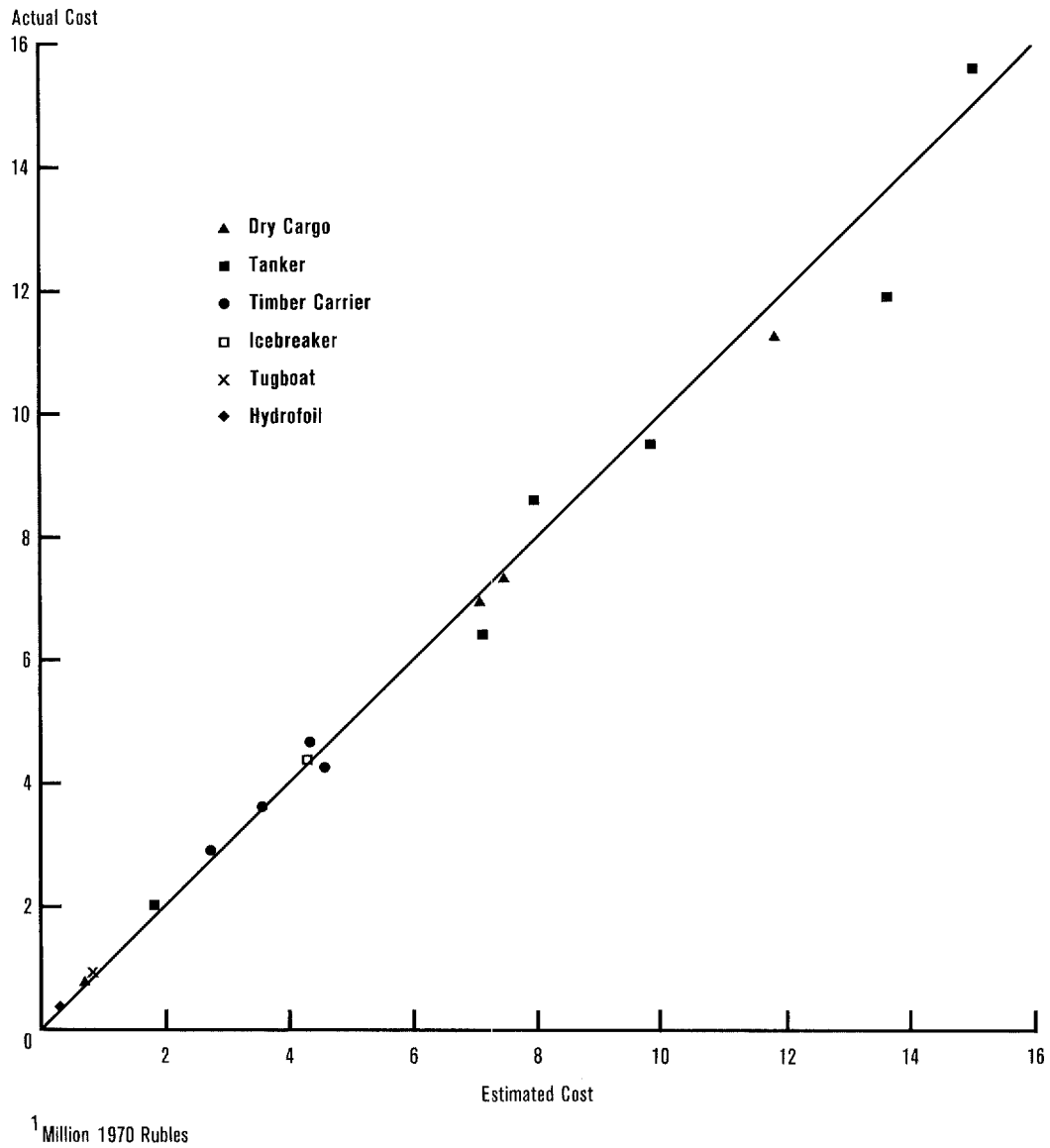
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Figure 3
Comparison of Estimated and Actual Ruble Cost of Soviet Merchant Ships¹



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Table A

Estimated and Actual Ruble Cost of Soviet Merchant Ships

Type and Name of Soviet Ship	Light Displacement (Tons)	Estimated Cost (Million Rubles)	Actual Cost (Million Rubles)	Deviation	
				(Million Rubles)	(Percent)
Dry Cargo					
Abruka	347	.715	.75	-.035	-5
Slavyansk	4,600	7.48	7.32	+.16	+2
Bezhitsa	6,330	7.06	6.95	+.11	+2
Kapitan Kushnarenko	7,153	11.82	11.25	+.57	+5
Tanker					
Baskunchak	1,260	1.83	2.00	-.17	-8
Mangyshlak	4,010	7.97	8.6	-.63	-7
Kazbak	4,800	7.13	6.4	+.73	+11
Velikiy Oktyabr'	4,860	9.83	9.5	+.33	+3
Praga	10,100	13.62	11.9	+1.72	+14
Sofiya	12,000	15.01	15.6	-.59	-4
Timber Carrier					
Baykal	1,040	2.74	2.9	-.16	-6
Sirbirles	1,833	3.58	3.6	-.02	-1
Seliger	2,407	4.58	4.25	+.33	+8
Vytegrales	3,300	4.34	4.66	-.32	-7
Icebreaker					
Vasiliy Pronchishev	2,055	4.31	4.36	-.05	-1
Tugboat					
BK-1201	260	.86	.897	-.037	-4
Hydrofoil					
Meteor		.32	.336	-.016	-5
Average percent deviation					5.5

same for naval as for merchant ships.⁷ Thus the cost factors for Soviet merchant and naval basic ships should be almost the same. Furthermore, nothing in available Soviet literature disproves the assumption that merchant cost planning factors can be used for estimating basic naval ship costs.

The above analyses of the factors contributing to the cost differential between US merchant and US naval ships and of Soviet shipbuilding practices all support the theory that the CER model can be used to estimate Soviet basic naval ship

⁷Conversations with experts in Soviet shipbuilding practices from NISC and NAVSEC.

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construction spending, provided the costs of special features are added. It is especially important, therefore, in estimating the cost of a naval ship to account for the special features which generally are not found on a merchant ship. The model does provide cost adjustment factors to account for these special features, thus making it possible to estimate the cost of basic naval ships.

One of the most significant differences between naval and merchant ships is the size of the crew. For example, although US Naval Amphibious Force Flagship AGC-20 and the C4-S-696

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Table B
Estimated Ruble Cost of Selected Major
Soviet Warships

Type	Class	Average Cost of Basic Ship (Million 1970 Rubles)
CL	Sverdlov	42.67
CG	Kynda	29.26
CG	Kresta I	31.16
CG	Kresta II	28.19
CG	Kara	33.0
DD	Krupnyy	27.41
DD	Kildin	28.57
DDG	Kashin	22.66
DD	Krivak	20.39
DD	Skoryy	16.43
DD	Kotlin	23.82
DD	Tallin	30.17
FF	Kola	10.16
FF	Riga	9.38
FFL	Mirka	13.19
FFL	Petya I	14.18
FFL	Petya II	13.10
CHG	Moskva	73.33
CVSG	Kiev	114.32
CVSG	Follow-on Kiev	125.47
DD	Follow-on Krivak	22.43
CG	Follow-on Kresta II	31.04
CG	Follow-on Kara	36.30
FF	Jaguar	15.00
CL	Kirov	37.24
CL	Chapayev	39.40

merchant cargo ship are similar in displacement and horsepower, the naval ship has accommodations for 1,465, while the merchant ship carries a crew of 51. The cost of auxiliary systems is related directly to the size of crew accommodations. The larger crew size of a naval ship also increases the requirement for environmental conditioning services and berthing and mess provisions. The Soviet model can be adjusted for additional crew.

The Soviet model has several formulas available, depending on the type of merchant ship that is being costed. To apply the model to naval

ships, therefore, it is necessary to select merchant ships to serve as analogs for different classes of naval ships.⁸ The principal criterion for selecting analogs is similarity of design and configuration. For example, a dry cargo ship is the best type of merchant ship for estimating the cost of the basic portion of a Soviet guided-missile destroyer.

The results of these cost calculations for several selected major Soviet warships are given in table B.

Ruble-Dollar Ratios

The accuracy of the Soviet costing model in producing average costs of ships of a given class makes it an excellent tool for deriving ruble-dollar ratios for the Soviet and US shipbuilding industries. By comparing the ruble costs of Soviet ships with the cost of producing such ships in the United States, we can develop Soviet-weighted ruble-dollar ratios. Such ratios depict the relative purchasing power of the currency of the two countries with respect to ships of Soviet design and technical characteristics. US-weighted ratios are derived by comparing the ruble and dollar costs of producing US ships. They reflect the relative costs of producing ships of US design and technical characteristics. Such ratios permit reasonably accurate conversion of the cost of the output of the shipbuilding industries of each of the two countries into the currency of the other.

Merchant Ships

Ruble cost estimates for several classes of Soviet merchant ships covering a wide range of displacements and costs were derived from the Soviet cost model and compared with dollar cost estimates of the same ships. The dollar estimates, reflecting what it would cost to build the Soviet ship in the United States, were furnished by the US Maritime Administration. Ruble-dollar ratios were then calculated for each class of ship. The results are shown in table C. The values of all of the observations fall within a range of .467 to .613 (1970 rubles to 1973 dollars)—an exceptionally narrow range for ruble-dollar calculations—and appear to be

⁸ A complete list is given in appendix D.

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normally distributed around mean and median values of .537 and .522, respectively.⁹

To complement this analysis, cost estimates were derived in both dollars and rubles for a sample of US merchant ships. The physical description and dollar cost data were obtained from the US Maritime Administration. The Soviet model was used to derive theoretical ruble costs. The results are given in table D. The values again appear to be normally distributed, with a mean of .647, median of .656, and a range of .542 to .757.¹⁰

The data in tables C and D illustrate that the average Soviet-weighted ratio is lower than the average US-weighted ratio. This accords with the economic principle that countries design and produce products for which they have a comparative advantage. In other words, the Soviets are slightly better (that is, have a lower ruble-dollar ratio) at building their own merchant ships than they would be at building US ships, and the converse is true for the United States.

Naval Ships

As discussed earlier, the model was used to estimate the average ruble costs of the basic portion of 26 different classes of Soviet warships. The dollar costs of these warships were then estimated by using a model developed by the Rand Corporation.¹¹ Ruble-dollar ratios were calculated and are shown in table E. The statistical properties of the sample are summarized in figure 4. The derived average ratio of .620 is somewhat higher than that for the Soviet-weighted sample for merchant ships, implying that the Soviets have a slight comparative advantage in producing merchant ships vis-a-vis naval ships. Like the sample for merchant ships,

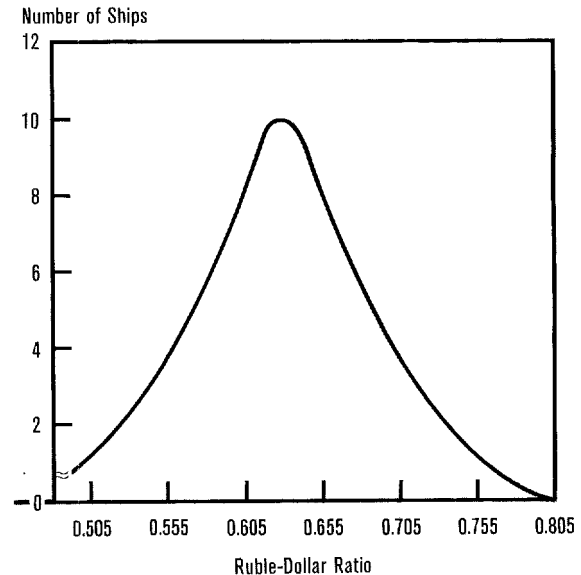
⁹The Kolmogorov-Smirnov statistical test applied to the sample results in a value of .173. At a significance level of 20 percent, a value in excess of .339 would have been needed to refute the assertion that the ratios are normally distributed.

¹⁰The Kolmogorov-Smirnov test gives a value of .135 for these samples. At a 20-percent significance level, a value larger than .339 is needed to reject the assertion that dispersion is normal.

¹¹R. P. Johnsons *et al.*, *Determination of Weight, Volume, and Construction Costs for Naval Combatants and Auxiliary Ships*, the Rand Corporation, Santa Monica, California, 1969.

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Figure 4
Frequency Curve of
Ruble-Dollar Ratios for
Selected Major Surface Combatants



Sample Size	: 26
Range	: 0.512 to 0.800
Mean	: 0.620
Variance	: 0.004
Standard Deviation	: 0.065
Coefficient of Variation	: ± 11 percent

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that for naval ships shows an exceptionally narrow dispersion about the mean value.

The statistical properties of the sample indicate a consistency of the results of the Soviet model with those of the Rand Corporation model. That is, by using a ruble-dollar conversion factor of .62, the Soviet model predicts the dollar costs of the naval ships within plus or minus 22 percent (with a 95 percent confidence interval). This consistency of results tends to confirm the validity of adapting the Soviet merchant ship model to costing naval ships.

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Table C
Ruble-Dollar Cost* of Soviet Merchant Ships

Type and Name of Ship	Light Displacement (Tons)	Cost of First Unit		Ruble- Dollar Ratio
		(Million 1970 Rubles)	(Million 1973 Dollars)	
Container Carrier - Aleksandr	3,460	7.94	14.0	.567
Container Carrier - Sestroretsk	3,760	7.97	16.24	.491
Dry Cargo - Dneproges	4,270	9.63	18.75	.514
Tanker - Velikiy Oktyabr'	4,860	11.14	21.70	.513
Dry Cargo - Capitan Kushnarenko	7,150	13.51	28.90	.467
Tanker - Pekin	8,100	14.61	26.88	.544
Bulk Carrier - Aleksandr Metrosov	11,200	17.30	28.70	.603
Tanker - Sofiya	12,000	17.13	32.80	.522
Tanker - Krym	30,200	36.11	58.94	.613
Average ruble-dollar ratio				.537

* Ruble and dollar estimates include design and shipyard equipment costs.

Table D
Ruble-Dollar Cost* of US Merchant Ships

Type and Name of Ship	Light Displacement (Tons)	Cost per Unit		Ruble- Dollar Ratio
		(Million 1970 Rubles)	(Million 1973 Dollars)	
Oceanographic S2-M-MA74a	1,800	6.32	9.63	.656
Tanker T6-S-93A	8,800	11.7	18.17	.644
Container Carrier C5-S-73B	10,330	12.87	17.00	.757
Container Carrier C7-S-88a	12,700	17.47	25.26	.692
Barge Carrier C8-S-81C	13,800	18.23	32.30	.564
Roll-on Roll-off C7-S-95a	15,900	21.20	37.37	.567
Lighter Carrier C9-S-81D	16,070	19.37	27.86	.695
Tanker T8-S-100B	16,800	19.60	27.86	.704
Tanker T11-S-116a	60,140	59.00	108.83	.542
Average ruble-dollar ratio				.647

* Ruble and dollar estimates include design and shipyard equipment costs.

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Table E

Ruble-Dollar Ratios* of Selected Major Warships

Type	Class	No. of Units	Million 1970 Rubles	Million 1973 Dollars	Ruble- Dollar Ratio	Total Cost (Millions)	
						1970 Rubles	1973 Dollars
CL	Sverdlov	14	42.6725	68.1531	.626	597.415	954.1434
CG	Kynda	4	29.2601	48.1431	.608	117.0404	192.5724
CG	Kresta I	4	31.1620	53.3167	.584	124.648	213.2668
CG	Kresta II	12	28.170	52.2335	.529	338.040	638.8020
CG	Kara	7	32.9993	64.4454	.512	230.9951	451.1178
DD	Krupnyy	8	27.4060	40.3612	.679	219.248	322.8896
DD	Kildin	4	28.5721	35.7062	.800	114.2884	142.8248
DDG	Kashin	20	22.6625	43.6687	.519	453.25	873.374
DD	Krivak	20	20.3869	34.8157	.586	407.738	696.314
DD	Skoryy	72	16.4348	26.8970	.611	1183.3056	1936.584
DD	Kotlin	27	23.8154	38.4591	.619	643.0158	1038.3957
DD	Tallin	1	30.1679	40.9412	.737	30.1679	40.9412
FF	Kola	8	10.1622	15.3370	.663	81.2976	122.696
FF	Riga	64	9.3774	13.9141	.674	600.1536	890.5024
FFL	Mirka	20	13.1883	20.1508	.654	263.766	403.016
FFL	Petya I	23	14.1780	20.6815	.686	326.094	475.6745
FFL	Petya II	37	13.1016	20.6815	.633	484.7592	765.2155
CHG	Moskva	2	73.3328	120.0874	.611	146.6656	240.1748
CVSC	Kiev	3	114.3184	187.2046	.611	342.9552	561.6138
CVSC	Follow-on Kiev	2	125.4657	205.4592	.611	250.9314	410.9184
DD	Follow-on Krivak	8	22.4256	38.2973	.586	179.4048	306.3784
CG	Follow-on Kresta II	6	31.0354	58.5568	.530	186.2124	351.3408
CG	Follow-on Kara	3	36.2992	70.8899	.512	108.8977	212.6700
FF	Jaguar	6	15.0038	22.7496	.660	390.0990	591.4900
CL	Kirov	6	37.24	59.0179	.631	223.44	354.1074
CL	Chapayev	5	39.40	61.7534	.638	197.00	308.7670
Average ruble-dollar ratio for basic ship					.620		

* Ruble-dollar ratios are for basic ships only.

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Appendix A

**Basic Ship Components Affecting
Cost Estimates****Hull and Equipment**

Frames
Skin
Bulkheads
Recesses
Decks and Platforms
Foundations for the Main Engines and Auxiliary Equipment
Stacks
Furniture and Equipment in the Compartments
Raw Items
Wood
Coatings
Insulation
Paint
Structures
Deck Machinery
General Ship's Systems
Electrical Equipment
Navigational and Radio Equipment
Fittings

Mechanical Equipment

Mechanical Equipment of Engine and Boiler Room
Shaft Alleys
Propellers
Main and Auxiliary Boilers

Distributing Boards
Lines Within Engine and Boiler Room

Main Engine

Main Engine Technical Specifications

Diesel Engine

Spare Parts
Instruments and Tools
Coolers
Heat Regulators
Filters
Tanks
Reduction Gear

Main Turbogear Assemblies

Turbine
Reduction Gear
Condenser

Diesel Electric Plants

Main Diesel Generators
Electric Propeller Drives

Construction Services

Docking Operations
General Auxiliary & Production Operations
Mooring Trials
Sea Trials
Acceptance Trials

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Appendix D

Guidelines for Selecting Merchant Ships as Analogs for Basic Naval Ships

To estimate the cost of specific basic naval ships, different types of merchant ships are used as analogs. The following data show the various examples:

I. Major Surface Combatants

CHG and CV—Dry Cargo

CA, CG, CL, & CLC—Dry Cargo or Average of Dry Cargo and Container Carrier

DD, DDG, FF, and FFL—Dry Cargo or Average of Dry Cargo and Refrigerated Ship

II. Minor Surface Combatants

PGGP—Dry Cargo or Average of Dry Cargo and Refrigerated Ship

PCEP—Average of Dry Cargo and Container Carrier

PB, PC, PCE, PCS, PGH, PGM, PT, PTC, PTF, PTFG, and PTG—Dry Cargo

MCS, MSB, MSC, MSF, MSI, and MSL—Dry Cargo

III. Amphibious Warfare Types

LKA and LCM—Dry Cargo

LCU, LPH, LSM, and LSV—Container or Lighter Carrier

LST—Average of Lighter Carrier and Roll-on/Roll-Off

IV. Auxiliaries

ADG and AFS—Dry Cargo

AEM—Average of Container Carrier or

Roll-on/Roll-off, and Dry Cargo

AETL—Container Carrier

AE—Refrigerated Ship

AG—Average of Dry Cargo and Refrigerated Ship and Tanker or Container Carrier

AGB and AGBL—Average of Dry Cargo and Refrigerated Ship (Ice reinforcement)

AGF and AGI—Dry Cargo

AGM—Average of Dry Cargo and Lighter Carrier

AGOR—Average of Refrigerated Ship and Container Carrier or Dry Cargo

AGS, AGT, and ALBD—Dry Cargo

AO and AOR—Tanker

AOS—Gas Carrier (Combined method for petrol gases)

AOSR—Gas Carrier

APB—Dry Cargo (Ice reinforcement)

AR and ARL—Average of Dry Cargo and Refrigerated Ship

ARC—Average of Dry Cargo and Tanker (Strengthened Steel)

AS, ASL, and ASR—Refrigerated Ships or Tugs or Dry Cargo

ATA and ATR—Dry Cargo

AWK—Tanker

V. Surface Craft

YAM, YF, and YRD—Dry Cargo or Container Carrier or Tanker, or average of all of these

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Appendix F

Glossary of Ship Designators

This glossary is based on work done by the Defense Intelligence Agency and published by them. This system is in general use.

Major Surface Combatants

Guided Missile Helicopter Ship	CHG
Aircraft Carrier	CV
Heavy Cruiser	CA
Light Cruiser	CL
Guided Missile Cruiser	CG
Command Light Carrier	CLC
Destroyer	DD
Guided Missile Destroyer	DDG
Frigate	FF
Small Frigate	FFL

Minor Surface Combatants

Large Submarine Chaser	PC
Patrol Escort	PCE
Small Submarine Chaser	PCS
Patrol Gunboat	PG
Patrol Guided Missile Boat (point defense)	PGGP
Motor Gunboat	PGM
Patrol Boat	PB
Patrol Gunboat (hydrofoil)	PGH
Motor Torpedo Boat	PT
Motor Boat Submarine Chaser	PTC
Fast Patrol Craft	PTF
Guided Missile Patrol Boat	PTG
Large Guided Missile Boat	PTFG
Mine Countermeasures Ship	MCS
Minesweeping Boat	MSB
Minesweeper, Coastal (nonmagnetic)	MSC
Minesweeper, Fleet (steel hull)	MSF
Minesweeper, Inshore	MSI
Minesweeper Launch	MSL

Amphibious Warfare Ships

Amphibious Cargo Ship	LKA
Landing Craft, Mechanized	LCM

Landing Craft, Utility	LCU
Amphibious Assault Ship	LPH
Medium Landing Ship	LSM
Tank Landing Ship	LST
Vehicle Landing Ship	LSV

Auxiliary Ships

Degaussing Ship	ADG
Ammunition Ship	AE
Missile Support Ship	AEM
Small Ammunition Transport	AETL
Combat Store Ship	AFS
Miscellaneous	AG
Icebreaker	AGB
Miscellaneous Command Ship	AGF
Intelligence Collector	AGI
Missile Range Instrumentation Ship	AGM
Oceanographic Research Ship	AGOR
Surveying Ship	AGS
Target Service Ship	AGT
Heavy Lift Buoy Tender	ALBD
Oiler	AO
Replenishment Oiler	AOR
Special Liquid Carrier	AOS
Radiological Liquid Carrier	AOSR
Barracks Ship	APB
Repair Ship	AR
Cable Repairing Ship	ARC
Landing Craft Repair Ship	ARL
Submarine Tender	AS
Small Submarine Tender	ASL
Submarine Rescue Ship	ASR
Auxiliary Ocean Tug	ATA
Rescue Ocean Tug	ATR
Water Carrier	AWK

Service Craft

Missile Support Craft	YAM
Covered Lighter	YF
Floating Dry Dock Workshop	YRD

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MEMORANDUM FOR: Mr. Andrew W. Marshall
Director of Net Assessment, OSD
Room 3-A-930, The Pentagon
Washington, D.C. 20301

The attached report details one
of the principal pieces of analysis
underlying the change which we made
last year in our estimate of Soviet
defense spending in rubles.

STAT

[REDACTED]
Chief
Military-Economic Analysis Center
OSR

#8

Date 22 AUG 1977

FORM 5-75 101 USE PREVIOUS EDITIONS

MEMORANDUM FOR: Mr. Paul K. Cook
Director, Office of Research and
Analysis for the Soviet Union
and Eastern Europe (INR/DDR/RSE)
Room 4758, State Department
Washington, D.C.

The attached report details one
of the principal pieces of analysis
underlying the change which we made
last year in our estimate of Soviet
defense spending in rubles.

STAT


[REDACTED]
Chief
Military-Economic Analysis Center
OSR

#12

22 AUG 1977

MEMORANDUM FOR: Mr. Daniel Gallik
Economic Division, Room 804
State Annex 6
Washington, D.C. 20451

The attached report details one of the principal pieces of analysis underlying the change which we made last year in our estimate of Soviet defense spending in rubles.


Chief
Military-Economic Analysis Center
OSR

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#13

Date 22 AUG 1977

FORM 5-75 101 USE PREVIOUS EDITIONS

MEMORANDUM FOR: Mr. J. Dale Pafenberg
Hdqs. USAF (INA)
Department of the Air Force
Washington, D.C. 20330

The attached report details one of the principal pieces of analysis underlying the change which we made last year in our estimate of Soviet defense spending in rubles.


Chief
Military-Economic Analysis Center
OSR

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22 AUG 1977

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